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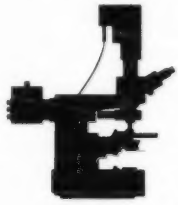
EMR SCIENTIFIC AUTHORITY A.W.F. Mo.

Results of X-Ray Diffraction Analyses of Mineral Species in Low Temperature Coal Ash.

March, 1987.

Prepared for

CANMET - Energy, Mines & Resources, Canada.



David E. Pearson & Associates Ltd.

Consulting Coal Geologists & Petrographers,

804 Leota Place,

Victoria,

British Columbia, V8Y 1H2, Canada.

MICROMEDIA

10 pp

David E. Pearson & Associates Ltd.
Consulting Coal Geologists & Petrographers

804 Leota Place, Victoria, B.C. V8Y 1H2 (604) 658-5963
Facsimile (Canon 520): (604) 658-1029

March 25, 1987.

Mr. Alfred Mo,
EMR - CANMET,
P.O. Bag No. 1310,
One Oil Patch Drive,
Devon, Alberta.
T0C 1E0

Dear Mr. Mo:

Re: XRD Analyses of Mineral Species in LTA Coal Ash.

We are pleased to provide you with our final report on the results of the X-ray diffraction analyses on low temperature coal ashes. We trust you will find the information to be most useful.

We thank you for the opportunity to have been of assistance to you.

Yours very truly,
David E. Pearson & Associates Ltd.,

David E. Pearson, Ph.D., P.Eng.

INTRODUCTION

This report describes the semi-quantitative mineralogical make-up of low-temperature ash (LTA) samples, as determined by X-ray diffraction analysis. The LTA mineral matter was isolated by radio-frequency plasma-ashing techniques and was provided by CANMET.

The X-ray diffraction analyses, which were sub-contracted to a third party laboratory, were carried out on a Phillips Norelco diffractometer using copper K radiation, operating at a power level of 40 KV and a current of 25 mA. The samples were scanned at a rate of 2° 2θ/min over the region of 5° 2θ - 65° 2θ. A scanning speed of 2° 2θ/min is considered optimum in terms of information obtained and economy of time. A slower speed of 1° 2θ/min does not provide sufficiently better resolution to warrant the longer analysis time. The chart speed was 20 mm/min.

The X-ray diffractograms, an example of which is shown in the appendix, were analysed by Dr. D.E. Pearson, as detailed in the contract. All peaks on the diffractograms were measured, and their corresponding d-values and (*hkl*) surfaces were determined. Individual mineral species were identified using the characteristic reflections as described by ASTM, and in the "Mineral Powder Diffraction File" published by the International Centre for Diffraction Data (JCPDS).

RESULTS

The results of all analyses are contained in Table 1, and the diffractograms from which these data were obtained are contained in a separate folio.

Sample	Size	Fraction	Quartz	Kaolinite	Mxd Layer Clays	Plagioclase	Siderite	Pyrite	Calcite	Dolom...	Flourapatite	Bassanite	Goyasite	Anatase	Apatite
AMO1	+0.6mm		Major	Major	Major										
	0.6x0.25mm		Major	Major	Major	Minor	Trace	Minor	Minor	Minor	Trace	Trace		Trace	
		-1.30FLT	Major	Major			Trace	Minor		Minor			Trace		Trace
		1.30x1.40FLT	Major	Major	Major		Trace	Minor	Minor	Minor			Trace		
		1.40x1.50FLT	Major	Major	Major		Trace		Minor	Minor	Trace				
		1.50x1.60FLT	Major	Major	Major		Trace	Minor							
		1.60x1.70FLT	Major	Major	Major	Minor		Minor	Minor	Minor					
		1.70x1.80FLT	Major	Major		Minor	Trace		Minor	Minor		Trace		Trace	
		1.80x1.90FLT	Major	Major	Minor	Minor	Trace	Minor	Minor	Minor					
		1.90x2.00FLT	Major	Major		Minor	Trace	Minor						Trace	
		2.00x2.17FLT	Major	Major	Minor	Trace	Trace		Minor	Minor					
		+2.17 Sink	Major	Major	Minor	Trace	Trace	Minor	Minor	Minor	Trace				
	0.25x0.15mm		Major	Major	Major	Minor	Trace	Minor	Minor	Minor					
		-1.30 FLT	Major	Major	Minor	Minor	Trace	Minor		Minor					
		1.30x1.40FLT	Major	Major	Major	Minor		Minor	Minor	Minor		Trace			Trace
		1.40x1.50FLT	Major	Major	Major		Trace	Minor	Minor	Minor	Trace			Trace	
		1.50x1.60FLT	Major	Major		Trace	Trace	Minor	Minor						
		1.60x1.70FLT	Major	Major	Minor	Trace			Minor	Minor					
		1.70x1.80FLT	Major	Major	Major		Trace	Minor	Minor	Minor			Trace		Trace
		1.80x1.90FLT	Major	Major	Major	Trace	Trace	Minor		Minor	Trace				
		1.90x2.00FLT	Major	Major		Trace		Minor	Minor						
		2.00x2.17FLT	Major	Major	Minor		Trace	Minor	Minor	Minor	Trace	Trace			
		+2.17 Sink	Major	Major	Minor	Trace	Trace	Minor	Minor	Minor	Trace			Trace	Trace
	0.15x0.044mm		Major	Major	Major	Trace	Trace	Minor	Trace	Minor		Trace		Trace	
		-1.30 FLT	Major	Major		Trace	Trace	Minor	Trace	Minor					
		1.30x1.40FLT	Major	Major	Minor	Trace	Trace	Minor	Minor	Minor	Trace	Trace			Trace
		1.40x1.50FLT	Major	Major	Minor	Trace	Trace	Minor	Minor	Minor					
		1.50x1.60FLT	Major	Major		Trace	Trace	Minor	Minor	Minor	Trace		Trace		
		1.60x1.70FLT	Major	Major	Major	Trace	Trace	Minor	Minor	Minor					
		1.70x1.80FLT	Major	Major	Minor		Trace	Minor	Minor	Minor				Trace	
		1.80x1.90FLT	Major	Major	Major		Trace	Minor	Minor	Minor			Trace		
		1.90x2.00FLT	Major	Major	Minor		Trace	Minor	Minor	Trace	Trace				Trace
		2.00x2.17FLT	Major	Major	Minor	Trace	Trace	Minor	Minor	Trace					
		+2.17 Sink	Major	Major	Trace	Trace	Trace	Minor	Minor	Trace			Trace		

Sample	Size	Fraction	Quartz	Kaolinite	Mxd Layer Clays	Plagioclase	Siderite	Pyrite	Calcite	Dolom...	Flourapatite	Bassanite	Goyasite	Anatase	Apatite
	-0.044mm		Major	Major	Major	Trace	Trace	Minor	Trace	Trace	Trace				Trace
		-1.30 FLT	Major	Major	Minor	Trace	Trace	Minor	Trace	Trace					
		1.30x1.40FLT	Major	Major	Major	Trace	Trace	Minor	Trace	Trace					
		1.50x1.50FLT	Major	Major	Minor	Trace	Trace	Minor	Trace	Trace	Trace				
		1.50x1.60FLT	Major	Major	Minor	Trace	Trace	Minor	Trace	Trace			Trace		Trace
		1.60x1.70FLT	Major	Major	Major	Trace	Trace	Minor	Minor	Trace		Trace			
		1.70x1.80FLT	Major	Major	Major	Trace	Trace	Minor	Minor	Trace		Trace			
		1.80x1.90FLT	Major	Major	Major	Trace	Trace	Minor	Minor	Trace					
		1.90x2.00FLT	Major	Major	Major	Trace	Trace	Minor	Minor	Trace					
		2.00x2.17FLT	Major	Major	Major	Trace	Trace	Minor	Minor	Trace		Trace			
		+2.17 Sink	Major	Major	Minor	Trace	Trace	Minor	Minor	Trace		Trace			
AMO2	+0.6mm		Major	Major	Major	Trace	Trace	Minor	Minor	Trace		Trace			
	0.6x0.25mm		Major	Major	Major	Trace	Trace	Minor	Minor	Minor		Trace		Trace	
		-1.30 FLT	Major	Major	Minor	Trace	Trace		Minor	Minor		Trace			
		1.30x1.40FLT	Major	Major	Major	Trace	Trace			Minor	Trace	Trace			
		1.40x1.50FLT	Major	Major	Major	Trace	Trace	Minor	Minor	Minor		Trace			Trace
		1.50x1.60FLT	Major	Major	Major	Trace	Trace	Minor	Minor	Minor					
		1.60x1.70FLT	Major	Major	Major	Trace	Trace		Minor			Trace			
		1.70x1.80FLT	Major	Major	Major	Trace	Trace	Minor	Minor	Minor	Trace	Trace			
		1.80x1.90FLT	Major	Major	Minor	Trace	Trace	Minor	Minor	Minor		Trace		Trace	
		1.90x2.00FLT	Major	Major	Minor	Trace	Trace	Minor	Minor	Minor	Trace	Trace			
		2.00x2.17FLT	Major	Major	Major	Trace	Trace	Minor		Minor		Trace			Trace
		+2.17 Sink	Major	Major	Minor	Trace	Trace	Minor	Minor	Minor	Trace	Trace			
	0.25x0.15mm		Major	Major	Major	Trace	Trace	Minor	Trace	Trace		Trace			
		-1.30 FLT	Major	Major	Minor	Trace	Trace	Minor	Trace	Trace		Trace			
		1.30x1.40FLT	Major	Major	Major	Trace	Trace	Minor	Trace	Trace		Trace			Trace
		1.40x1.50FLT	Major	Major	Minor	Trace	Trace	Minor	Trace	Trace		Trace	Trace	Trace	
		1.50x1.60FLT	Major	Major	Major	Trace	Trace	Minor	Trace	Trace		Trace			
		1.60x1.70FLT	Major	Major	Major	Trace	Trace	Minor	Trace	Trace		Trace		Trace	
		1.70x1.80FLT	Major	Major	Major	Trace	Trace	Minor	Trace	Trace		Trace			
		1.80x1.90FLT	Major	Major	Minor	Trace	Trace	Minor	Trace	Trace		Trace	Trace		
		1.90x2.00FLT	Major	Major	Major	Trace	Trace	Minor	Trace	Trace	Trace	Trace			
		2.00x2.17FLT	Major	Major	Major	Trace	Trace	Minor	Trace	Trace		Trace			Trace
		+2.17 Sink	Major	Major	Minor	Trace	Trace	Minor	Trace	Trace	Trace				
	0.15x0.044mm		Major	Major	Major	Trace	Trace	Minor	Trace	Trace		Trace			

Sample	Size	Fraction	Quartz	Kaolinite	Mxd Layer Clays	Plagioclase	Siderite	Pyrite	Calcite	Dolom...	Flourapatite	Bassanite	Goyasite	Anatase	Apatite
		-1.30 FLT	Major	Major	Major	Trace	Trace	Minor	Trace	Trace	Trace	Trace			
		1.30x1.40FLT	Major	Major	Minor	Trace	Trace	Minor		Trace		Trace		Trace	
		1.40x1.50FLT	Major	Major	Minor			Minor	Trace	Trace		Trace			Trace
		1.50x1.60FLT	Major	Major	Minor		Trace	Minor	Trace		Trace	Trace		Trace	
		1.60x1.70FLT	Major	Major	Major	Trace	Trace		Trace		Trace	Trace			
		1.70x1.80FLT	Major	Major	Major	Trace	Trace	Minor	Trace		Trace	Trace		Trace	
		1.80x1.90FLT	Major	Major	Major	Minor	Trace	Minor	Trace			Trace			
		1.90x2.00FLT	Major	Major	Major	Trace	Trace	Minor	Trace						
		2.00x2.17FLT	Major	Major	Minor		Trace			Trace					
		+2.17 Sink	Major	Major	Major	Trace	Trace	Minor	Trace	Trace					
	-0.44mm		Major	Major	Minor	Trace	Trace	Minor	Trace	Trace	Trace	Trace			
		-1.30 FLT	Major	Major	Major	Trace	Trace	Minor	Trace			Trace			
		1.30x1.40FLT	Major	Major	Minor	Trace	Trace	Minor		Trace	Trace	Trace		Trace	
		1.40x1.50FLT	Major	Major	Major	Trace			Trace	Trace		Trace			
		1.50x1.60FLT	Major	Major	Minor	Trace			Trace	Trace	Trace	Trace			
		1.60x1.70FLT	Major	Major	Major	Trace	Trace	Minor	Trace	Trace		Trace			
		1.70x1.80FLT	Major	Major	Minor	Trace	Trace	Minor	Trace	Trace		Trace			
		1.80x1.90FLT	Major	Major	Major	Trace		Minor	Trace	Trace		Trace			Trace
		1.90x2.00FLT	Major	Major	Major	Trace		Minor	Trace	Trace		Trace	Trace		
		2.00x2.17FLT	Major	Major	Major	Trace	Trace	Minor	Trace	Trace		Trace			
		+2.17 Sink	Major	Major	Minor	Trace	Trace	Minor	Trace	Trace		Trace			
AMC3	+0.6mm		Major	Major	Major	Trace	Trace	Minor		Trace	Trace	Trace			
	0.6x0.25mm		Major	Major	Major	Trace	Trace	Minor	Trace	Trace	Trace		Trace		Trace
		-1.30 FLT	Major	Major	Major		Trace	Minor	Trace	Trace					
		1.30x1.40FLT	Major	Major	Minor	Trace	Trace					Trace			
		1.40x1.50FLT	Major	Major	Major	Trace	Minor	Minor			Trace	Trace			
		1.50x1.60FLT	Major	Major	Major		Trace	Minor				Trace	Trace		
		1.60x1.70FLT	Major	Major	Major	Trace	Trace	Minor				Trace			Trace
		1.70x1.80FLT	Major	Major	Major	Trace	Trace	Minor				Trace			
		1.80x1.90FLT	Major	Major	Minor		Trace								
		1.90x2.00FLT	Major	Major	Major	Trace	Trace	Minor							
		2.00x2.17FLT	Major	Major	Minor	Trace	Trace	Minor							
		+2.17 Sink	Major	Major	Major		Trace	Minor							
	0.25x0.15mm		Major	Major	Major	Trace	Trace	Minor							
		-1.30 FLT	Major	Major	Major	Trace	Trace	Minor							

Sample	Size	Fraction	Quartz	Kaolinite	Mxd Layer Clays	Plagioclase	Siderite	Pyrite	Calcite	Dolom...	Flourapatite	Bassanite	Goyasite	Anatase	Apatite
		1.30x1.40FLT	Major	Major	Minor	Trace	Trace	Minor							
		1.40x1.50FLT	Major	Major	Major	Trace	Trace	Minor	Trace	Trace					
		1.50x1.60FLT	Major	Major	Major	Trace	Trace	Minor	Trace	Trace					
		1.60x1.70FLT	Major	Major	Major	Trace	Trace	Minor	Trace	Trace					
		1.70x1.80FLT	Major	Major	Minor	Trace	Trace	Minor	Trace	Trace					
		1.80x1.90FLT	Major	Major	Major	Trace	Trace	Minor	Trace	Trace					
		1.90x2.00FLT	Major	Major	Major	Trace	Trace	Minor	Trace	Trace		Trace			Trace
		2.00x2.17FLT	Major	Major	Minor	Trace	Trace	Minor	Trace	Trace		Trace			
		+2.17 Sink	Major	Major	Major	Trace	Trace	Minor	Trace	Trace	Trace	Trace		Trace	
	0.15x0.044mm		Major	Major	Major	Trace	Trace	Minor	Trace	Trace					
		-1.30 FLT	Major	Major	Major	Trace		Minor	Trace	Trace		Trace			Trace
		1.30x1.40FLT	Major	Major	Minor		Trace	Minor	Trace	Trace	Trace	Trace			
		1.40x1.50FLT	Major	Major	Major	Trace	Trace	Minor	Trace	Trace		Trace	Trace	Trace	
		1.50x1.60FLT	Major	Major	Minor	Trace	Trace	Minor	Trace			Trace			
		1.60x1.70FLT	Major	Major	Minor		Trace	Minor	Trace	Trace					
		1.70x1.80FLT	Major	Major	Major	Trace	Trace	Minor		Trace		Trace		Trace	
		1.80x1.90FLT	Major	Major	Minor	Trace	Trace	Minor	Trace	Trace		Trace		Trace	
		1.90x2.00FLT	Major	Major	Minor		Trace	Minor	Trace			Trace		Trace	
		2.00x2.17FLT	Major	Major	Minor	Trace		Minor	Trace	Trace					
		+2.17 Sink	Major	Major	Major	Trace	Trace	Minor	Trace	Trace					
	-0.044mm		Major	Major	Minor	Trace	Trace	Minor				Trace			
		-1.30 FLT	Major	Major	Major	Trace	Trace	Minor			Trace	Trace			Trace
		1.30x1.40FLT	Major	Major	Major			Minor				Trace	Trace		
		1.40x1.50FLT	Major	Major	Minor	Trace	Trace	Minor			Trace	Trace			
		1.50x1.60FLT	Major	Major	Major		Trace	Minor				Trace			
		1.60x1.70FLT	Major	Major	Major	Trace	Trace	Minor				Trace			Trace
		1.70x1.80FLT	Major	Major	Minor		Trace	Minor			Trace	Trace			
		1.80x1.90FLT	Major	Major	Major	Trace		Minor			Trace			Trace	
		1.90x2.00FLT	Major	Major	Minor	Trace	Trace	Minor							Trace
		2.00x2.17FLT	Major	Major	Major		Trace	Minor			Trace			Trace	
		+2.17 Sink	Major	Major	Minor	Trace	Trace	Minor				Trace			

APPENDICES

RECORDING CHARTS

CHART NO. PM9901

RECORDING CHARTS

CHART NO. PM9901